Grand Challenges Explorations Application Form

Please enter proposal text in Sections I and II, according to the instructions within each section. If you choose to include charts, graphs, or references, add them within the appropriate section. **Please do not include charts or graphics in color.**

Your application must be no longer than 2 pages, using 11 point type. The entire file should be less than 2MB. Proposals that do not adhere to these restrictions may be blocked from submission and review.

Section I. What is your idea?

Use this section to briefly describe your idea. Make sure that your idea directly fits the topic; otherwise your proposal may be disqualified.

- Indicate in one or two sentences **in bold** the essence of your idea.
- Why is your idea an unconventional or creative approach to the problem outlined in the topic?
- Describe the scientific basis for your idea and why you expect it to succeed.

Section II. How will you test it?

Use this section to briefly describe the project design and implementation plan.

- Describe your experimental plan, including any new technologies or tools to be developed.
- How will the work you describe be performed within the budget (USD$100,000) and time period (eighteen [18] months) allocated for the initial Phase I award? This 18 month time period should assumes an approximate 12 month project work time with the additional six months to be used for ramp up and required reporting.
- What essential data will you generate during your Phase I award?
- If your experiments in Phase I are successful, what are the next steps?

Bridge to a Better World: Pacemaker Recycling

Section I

Essence of the Idea

Each year more than a million individuals worldwide die due to lack of access to pacemakers; yet, most individuals with pacemakers would donate their device to others in need, recycle used pacemakers, if given the chance. We propose to employ current technology to target one set of potential donors (from the American Contract Bridge League) and one set of potential recipients (from a University of Michigan study being conducted in Bolivia). We would conduct a census of living potential pacemaker donors from a target group of over 165,000 duplicate bridge players (average age of 69) in which the density of existing pacemakers must be larger than in a corresponding random group. On the other side of the equation, we map a target group of recipients in Bolivia, suffering from Chagas disease and heart rhythm problems. Deliverables are thus a registration and tracking website, an associated census of the donor and recipient pools, and an atlas of the donor and recipient pools.

Creative Approach

Currently, there is no census of pacemakers, at either the donor or recipient end. Donation of natural organs is often tracked using notations on driver licenses. Everyone has a heart; not everyone has a pacemaker. Thus, tracking of these artificial organs differs from that of natural organs. Donor wallet cards are in place; interactive, online registration and tracking, is not. Recipients of organs, natural or artificial, are not mapped or tracked. Current technology, utilizing internet and mobile tools, permits mapping and spatial analysis in ways that were not previously possible.

Scientific Basis

Recycling has a sound environmental basis. Pacemakers have a sound medical basis. Integrating these concepts for the benefit of a large segment of the world's population without access to pacemaker therapy makes sense. The process works: a scientifically grounded pacemaker recycling program is in place at The University of Michigan (UM) Cardiovascular Center (http://www.myheartyourheart.org/). To date, they have collected over 4000 devices; roughly one in five have at least 70% of the original battery life left. What is missing is technology to count and/or track living potential donors. Each year over 100,000 pacemakers are implanted in the US (http://www.surgeryencyclopedia.com/La-Pa/Pacemakers.html). Worldwide, there are over 3 million existing pacemaker implants with about 600,000 new implants annually (http://circ.ahajournals.org/content/105/18/2136.full).

We propose to work with that University of Michigan program, and also with the American Contract Bridge League (ACBL), to develop a census of the ACBL pacemaker donor population (http://www.acbl.org/). We also propose to develop geographical bases for selection of target recipient groups through an existing study in Bolivia, screening for Trypanosoma cruzi, funded through Brown University on a Fogarty scholarship. We are applying through an existing organization outside the realm of either the academic or business organizations we are attempting to link.

Hypothesis 1: If living North American bridge players with pacemakers know about pacemaker recycling then they will be more inclined to posthumously donate their pacemakers to an existing program to benefit developing nations and thus to a census of such individuals.

Hypothesis 2: If living individuals in a developing world area, with an existing dense pocket of Chagas disease (with consequent associated heart rhythm problems) can be identified, mapped, and screened for disease, then pacemaker distribution can be optimized.

The ACBL group serves as a tightly knit set, capable of quick comprehension of the project, with greater pacemaker density than might otherwise be expected. The quality of life in this group is quite high—they have access to good medical networks and presumably to good medical hardware. Pacemaker recycling permits the transfer of this quality to those in the developing world who are not otherwise able to acquire it.

Success in structuring a census will be tied to other existing successful programs. We expect success based on published evidence from the UM cardiologists that most people would donate their device if only they knew, in advance, about the recycling program. We also expect it based on our strong and continuing administrative experiences with ACBL administration.

Success in mapping will be tied to an existing university-conducted field study program (in Bolivia) conducting ultrasound of the heart in areas in which the Chagas disease parasite is endemic. An atlas will be formed from the spatial data based on GPS entries in GIS and online mapping software.

Section II. Testing the Idea

Testing and implementation of the hypotheses would be aided by the fact that individuals receiving pacemakers already receive an identification card from the manufacturer that includes information about the specific model of pacemaker and its serial number.

Targeted donor group: the American Contract Bridge League—First 12 months.
Targeted recipient group: Bolivians targeted by the existing Trypanosoma cruzi parasite screening group: First year

- Donor cards available for ACBL members in Seattle. One publication about this project appeared in the ACBL Western Conference Forum; a letter to the editor appears in the November 2011 issue of the ACBL Bulletin. More publications are planned. Cost: $2000.
- Creation of an interactive online form for the ACBL website to use, if they are willing, employing the same website firm as is doing the current total overhaul of that site (http://openskywebdesign.com/). Website design and custom online census creation for both donor and recipient target pools. Cost: $20,000 maximum
- Spatial analysis using GIS software and online mapping tools of both donor and recipient populations. For example, we will take GPS data from Bolivian Chagas victims and map it in Google Earth so that we can see the spatial pattern of disease in relation to the existing environment in remote parts of the world. Product: an atlas. Cost: $10,000
- Medical analysis of program with input from a variety of professionals. Cardiovascular specialists and team professionals. Possible support for legal issues related to pacemaker export to countries outside the US. Cost: $30,000
- **Reporting of results. At the end of the first year, we would produce: a website for registration and tracking of donor and recipient pools, a census of donor and recipient pools, and an atlas of donor and recipient pools.**

Ramping it up--Far-flung group: Months 12 to 18.

- Natural organ donation is tied to Driver's License registration. We believe that artificial organ donation, such as pacemakers, could be tied to such documents in the United States.
- Communicating on a state by state basis with each of the Driver's License bureaus (all 50 Secretaries of State). Cost: for postage and related supplies and time: $200 for each State, so $10,000.
- Spatial and other analysis of the previous step. Cost: $10,000.
- Reporting of results: metadata and analysis of evidence reported in standard professional journals. Pilot website, census, and atlas (of Phase I—ACBL donor pool, Bolivian Chagas recipient pool) would serve as the basis for enlarging the project to the global scale. Cost: $10,000

Phase I, Pilot Project for Phase II. Estimated cost: $92,000.
Next Steps (below) to lead to Phase II: $8,000 for ground work on these

- Target AARP and other organizations.
- Expand census to include all artificial organs required by crematorium requirements to be removed (lest they cause an explosion). Introduce results of Phase I to other groups associated with a variety of artificial organs.
- Global census
    - Customize existing United Nations software to create a new program, "CardioInfo," for example (http://www.devinfo.org/). Today's developing nation pacemaker recipient may become tomorrow's donor.
    - Identify other existing dense pockets of pacemaker need, in relation to other diseases, in collaboration with scholars in the medical community—as we did for Chagas in Phase I.